DOCUMENT RESUME

ED 097 437 CE 002 199

TITLE	Washing Machines--Components & Operations; Appliance Repair 2: #9025.03.
INSTITUTION	Dade County Public Schools, Miami, Fla.
PUB DATE	Mar 73
NOTE	28p.; An Authorized Course of Instruction for the Quinmester Program
EDRS PRICE	MF-$0.75 HC-$1.85 PLUS POSTAGE
DESCRIPTORS	*Appliance Repairing; Course Content; Course Objectives; *Curriculum Guides; Electrical Appliances; Equipment Maintenance; Job Skills; *Performance Criteria; Post Secondary Education; Secondary Grades; *Technical Education; Vocational Education
IDENTIFIERS	Florida; *Quinmester Program

ABSTRACT

Designed to familiarize the student with the components and operations of automatic washing machines, this course outline offers instruction on the principles of washing and their relation to the automatic washer, the functions and operations of washer components, identification of various component malfunctions, washer installation, and the overhaul and repair of components. Course content includes goals, specific block objectives, orientation, automatic washers, water system components (valves, pumps, hoses), drive system components (transmissions, clutches, drive motors), washing machine overhaul, a post-test, and a bibliography. The appendix contains a Quinmester post-test sample. (NH)

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AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

DADE COUNTY PUBLIC SCHOOLS

Course Outline
APPLIANCE REPAIR 2 - 9025
(Washing Machines: Components and Operations)
Department 48 - Quin 9025.03

DIVISION OF INSTRUCTION • 1973

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D A D E C O U N T Y P U B L I C S C H O O L S
1 4 5 0 N O R T H E A S T S E C O N D A V E N U E
M I A M I, F L O R I D A 33132

Course Outline

APPLIANCE REPAIR 2 - 9025
(Washing Machines: Components and Operations)

Department 48 - Quin 9025.03

county office of
VOCATIONAL AND ADULT EDUCATION

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Dr. E. L. Whigham, Superintendent of Schools
Dade County Public Schools
Miami, Florida 33132

March, 1973

Published by the School Board of Dade County

PREFACE

The following quinmester course outline is presented to introduce and familiarize the student to the components and operations of automatic washing machines. It is intended that this course will permit the learner to become familiar with the principles of washing and their relation to the automatic washer. It will serve to instruct him in the functions and operations of washer components, and will teach him to recognize and identify various component malfunctions. The course also serves to provide the student with a knowledge of the job operations involved in washer installation and the overhaul and repair of washer components, as well as offering him an opportunity to exercise and practice these specific manipulative arts.

This course may be taught in a single quinmester session (1 hour class) for 45 hours, a double quinmester session (2 hour class) for 90 clock hours or in a triple quinmester session (3 hour class) for 135 clock hours. In each instance, the course consists of six blocks of instruction, however, the double or triple session permits the student to cover each block in more detail and also provides added opportunity in which to practice and increase his skills.

Manipulative instructional methods include demonstration and shop use of actual appliances and test equipment as well as mock-ups and demonstration units. Related instruction is taught through lecture, books, service manuals, instructional sheets, charts, and chalkboard presentations. Students are expected to keep notebooks and to complete daily related and manipulative assignments.

An adjunct to the listed instructional methods is provided through the instructors utilization of audiovisual equipment and materials.

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This outline was developed through the cooperative efforts of the instructional and supervisory personnel, the Quinmester Advisory Committee, and the Vocational Curriculum Materials Service, and has been approved by the Dade County Vocational Curriculum Committee.

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with Suggested Hourly Breakdown

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GOALS

The student must be able to:

1. Compare the similarities of operation between washers and other major appliances.
2. Describe and explain the operations of an automatic washer.
3. Install, demonstrate and post-check washers.
4. Identify washer components and describe their functions and operation.
5. Identify breakdowns and malfunctions, and relate them to specific components.
6. Remove washer components, disassemble them, identify worn or defective component parts, reassemble and reinstall components in washer.

SPECIFIC BLOCK OBJECTIVES

BLOCK I - ORIENTATION

The student must be able to:

1. Differentiate between timed fill and positive fill washers.
2. Explain the electrical effects as it relates to the functional use of electricity in a washer.
3. Work in a safe and responsible manner and thereby demonstrate his understanding of school and shop safety rules.
4. Exhibit the ability to apply previous knowledge and skills learned in appliances to work on automatic washers.

BLOCK II - AUTOMATIC WASHERS

The student must be able to:

1. Remove and replace washer panels, lids and other static components in order to service functioning components.
2. Discuss the purpose and function of the automatic washer as it relates to the principles of washing.
3. List the sequential operations of a washer and compare them to the washer cycles.
4. Install a washer, making all plumbing and electrical connections necessary for a proper, normal installation.
5. Demonstrate the proper use of a washer to someone who has never operated one.
6. Post check the washer to detect any variance of normal operations; check for poor connections, water leaks, off-balance, or any other installation errors.

BLOCK III - WATER SYSTEM COMPONENTS

The student must be able to:

1. Visually identify and state the functions of the different type valves used in washers.
2. Disassemble valves, name, and describe the purpose and operation of their component parts.
3. Reassemble valves; identifying, removing, and replacing worn or defective parts.
4. Visually identify and state the functions and operations of different type pumps used in washers.
5. Disassemble and reassemble pumps, naming all component parts, describing their function, and identifying worn or defective parts.
6. Identify and explain the function of the various hoses used in automatic washer.

BLOCK IV - DRIVE SYSTEM COMPONENT

The student must be able to:

1. Identify various washing machine transmissions; explain their functions and methods of operation.
2. Disassemble and reassemble transmissions, naming and describing the function of the various internal gears and associated component parts, and identifying worn or defective parts.
3. Identify various types of clutches used in washers; explain their principles of operation, their function, and methods of operation.
4. Disassemble and reassemble clutches, naming and describing the function of their internal parts and identifying worn or defective parts.
5. Identify the various types of drive motors and associated motor components found in washing machines; explain their functions and methods of operation.
6. Remove, check, and replace externally mounted motor centrifugal switches.
7. Interpret information on a motor rating plate, relating this to motor specifications and performance.

BLOCK V - WASHING MACHINE OVERHAUL

The student must be able to:

1. Locate and identify nonoperative washing machine mechanical or electromechanical components.
2. Remove and replace washing machine nonoperating components employing correct sequential procedures and utilizing the proper tools and methods.

BLOCK VI - QUINMESTER POST-TEST

The student must be able to:

1. Satisfactorily complete the quinmester post-test.

Course Description

9025	48	9025.03	Washing Machines: Components and Operations
State Category Number	County Dept. Number	County Course Number	Title

This course includes removing, rebuilding and replacing washer components, operations and functions of components, identifying component malfunctions, and washing machine installation procedures. This is a one, two or three quinmester credit course.

Indicators of Success: Prior to entry into this course, the student will display mastery of the skills indicated in Automatic Dryers: Circuitry and Troubleshooting (9025.02)

Clock Hours: 45, 90, 135

Course Outline

APPLIANCE REPAIR 2 - 9025
(Washing Machines: Components and Operations)

Department 48 - Quin 9025.03

I. ORIENTATION

A. Introduction
1. Automatic clothes washer
a. Timed drill
b. Positive fill
2. Relating basic electricity to washer operations
a. Practical use of the "magnetic" effect
b. Mechanical energy

B. Student Responsibilities
1. Safety
a. Identifying hazards
b. Working on washers with others
c. Shop and school safety rules
2. Shop regulations
a. Care of equipment
b. Reporting lost or damaged articles
c. Clean-up assignments

C. Course Benefits
1. Advancing trade knowledge
a. Working on a washing machine
b. Comparisons with, and to, working on a dryer
2. Preparation for the next course

II. AUTOMATIC WASHERS

A. Construction
1. The cabinet
a. Cabinet panels
b. The outer and inner tubs
c. The suspension system
(1) Suspension rods, springs, cables
(2) Tub base support
(3) Levelling legs
2. The console
a. The control panel
b. Console lamps

B. Principles of Washing
1. The washing medium
a. Hot water
b. Detergent or soap
c. Agitation
2. Rinsing
3. Water extraction and damp dry

4. Washer cycles
   a. Fill
   b. Wash
   c. Rinse
   d. Extract

C. Installation
   1. Installing the washer
      a. Plumbing requirements
      b. Electrical requirements
   2.- Post check
      a. Demonstration
      b. Checking washer performance

III. WATER SYSTEM COMPONENTS

A. Valves
   1. Inlet valves
      a. Types and functions
         (1) Single inlet
         (2) Two-coil
         (3) Three-coil
      b. Operation
      c. Valve disassembly
         (1) Parts numenclature
         (2) Component parts function and operation
      d. Valve rebuilding
         (1) Identifying defective component parts
         (2) Reassembly
   2. Recirculating valves
      a. The two-way valve
         (1) Functions
         (2) Operation
      b. Disassembly and reassembly

B. Pumps
   1. Principles of operation
      a. Types and functions
         (1) Single function pumps
         (2) Dual function pumps
      b. Methods of operation
         (1) Reverse rotation
         (2) Solenoid actuated
         (3) Internal valve
         (4) Direct drive
         (5) Pulley drive
   2. Pump disassembly
      a. Parts nomenclature
      b. Component parts function and operation
      c. Pump rebuilding
         (1) Identifying defective component parts
         (2) Reassembly

III. WATER SYSTEM COMPONENTS (Contd.)

C. Hoses
1. Drain hoses
a. Types and functions
(1) Sump hoses
(2) Molded hoses
b. Inlet hoses
(1) Inlet baffle hoses
(2) Hot and cold water hoses

IV. DRIVE SYSTEM COMPONENT

A. Transmissions
1. Principles of operation
a. Types and functions
b. Methods of operation
2. Disassembly
a. Nomenclature and component part function
b. Identifying defective component parts
c. Rebuilding and reassembly

B. Clutches
1. Types, functions and principles of operation
a. Friction clutch
b. Centrifugal clutch
c. Spring clutch
2. Method of operation
a. Reverse rotation
b. Solenoid actuated
3. Disassembly
a. Nomenclature and component part function
b. Rebuilding and reassembly

C. Drive Motors
1. Types
a. Split-phase
b. Capacitor-start
c. Relay-start
2. Motor components
a. Pulleys and belts
b. Externally mounted centrifugal switch
3. Method of operations and functions
a. Single-speed motors
b. Multi-speed motors
c. Unidirectional and bidirectional motors
4. Motor ratings
a. h.p.
b. Direction
c. Speed
d. Voltage and amperage

V. WASHING MACHINE OVERHAUL

A. Nonoperating Components
   1. Water system component malfunctions
      a. Water inlet
      b. Drain and recirculate
      c. Leaks and flooding
   2. Drive system component malfunctions
      a. Agitate
      b. Spin dry
      c. No mechanical operations

B. Removal and Installation
   1. Water system components
      a. Valves
      b. Pumps
      c. Hoses
   2. Drive system components
      a. Transmissions
      b. Clutches
      c. Drive motors
      d. Belts

VI. QUINMESTER POST-TEST

BIBLIOGRAPHY
(Washing Machines: Components and Operations)

Basic References:

1. How To Read A.S.A. Wiring Diagrams. Booklet G-3 #821349. La Porte, Indiana: Whirlpool Corp., 1965. Pp. 28.

2. Marcus, Abraham. Basic Electricity. 2nd ed. Englewood - Cliffs, New Jersey: Prentice Hall, Inc., 1964. n.p.

Supplementary References:

3. Appliance Motors. Manual #9911. Mansfield, Ohio: Westinghouse Corp., Major Appliance Service Department, 1967. Pp. 36.

4. Automatic Washer - Electrical Controls. Booklet L-24 #828995. La Porte, Indiana: Whirlpool Corp.

5. Automatic Washers. Electrical, Water and Mechanical Systems. Booklet L-4 #820852. La Porte, Indiana: Whirlpool Corp.

6. Trouble Diagnosis and Service Procedures. Booklet G-7 #828977. La Porte, Indiana: Whirlpool Corp.

Filmstrips and Cassettes:

1. Automatic Washer Electrical Controls. Filmstrip L-24 #828993. La Porte, Indiana: Whirlpool Corp.

2. Automatic Washer Electrical Controls. Cassette L-24 #828994. La Porte, Indiana: Whirlpool Corp.

3. Circuitry and Problem Diagnosis. Filmstrip L-15 #821455. La Porte, Indiana: Whirlpool Corp.

A P P E N D I X

Quinmester Post Test Sample

Quinmester Post Test

Name _____ Date _____ Score ____

Block I - Related Test

Place a "T" in the space provided next to each statement if you believe the statement is True, and place an "F" if you believe it to be False.

1. A "flow washer" will compensate for high or low water pressure in a timed-fill washer. ____
2. A "pressure switch" is most likely to be found in a positive-fill washer. ____
3. Most washers use the positive-fill method. ____
4. A solenoid is a good example of a mechanical effect produced by electricity. ____
5. A drive motor is a good example of a mechanical effect produced by electricity. ____
6. You should never try to remove a component unless you are sure the washer is plugged in properly polarized. ____
7. If a tool you are using is greasy or oily, you should wrap a rag around the handle when using it. ____
8. Automatic dryers, ranges, and automatic washers all use heating elements. ____
9. Automatic washers and dryers use drive motors. ____
10. Automatic washers will generally use more current than electric dryers or ranges. ____

Quinmester Post-Test

Name _____ Date _____ Score ____

Block II - Related Test

Each statement needs a word, a figure, or a phrase to make it correct. Only one of the choices listed is correct. Place the letter of the choice you make in the space provided at the right edge of the sheet.

1. Washing machine removable panels are located:

   a. On top of the washer
   b. Beneath the washer
   c. On the back of a washer
   d. On the front of a washer
   e. Any of the above ____

2. Agitation is primarily used to:

   a. Help hold the soil particles in suspension
   b. Help release the soil particles from the mesh
   c. Help prevent the clothes from shrinking
   d. Help the bleach mix with the detergent
   e. Help the detergent from "breaking down" ____

3. A detergent, in addition to helping to remove soil particles, also helps to:

   a. Hold the particles in suspension
   b. Maintain the water temperature
   c. Prevent stains
   d. Prevent clothes from shrinking
   e. Rinse soften the clothes ____

4. The first operation of a washer is to:

   a. Spin
   b. Rinse
   c. Fill
   d. Agitate
   e. Drain ____

5. When in the "wash" cycle, the washer will also be functioning in:

   a. Agitate
   b. Spin
   c. Fill
   d. Rinse
   e. Drain ____

6. When in the "spin" cycle, the washer will also be functioning in:

   a. Agitate
   b. Fill
   c. Wash
   d. Drain
   e. All of the above ____

7. Washing machines operate from a voltage supply of most nearly:

   a. 120/240 volts A.C.
   b. 120 volts A.C. only
   c. 240 volts A.C. only
   d. 120 volts D.C. only
   e. 240 volts D.C. only ____

8. A hose which may be found to have a molded in ground wire is:

   a. The drain hose
   b. The hot water hose
   c. The cold water hose
   d. Could be either inlet hose
   e. Could be any hose ____

9. In the post check you will usually:

   a. Check for water leaks
   b. Check for proper balance
   c. Check for proper operation of all cycles
   d. Check for normal functioning of all components
   e. Check for all things listed above ____

10. A proper demonstration consists of:

   a. Explaining the operator's manual to owner
   b. Showing owner how to use washer
   c. Showing owner how to use washer and observing her use it
   d. Observing owner use washer
   e. Telling her to read operator's manual ____

QUINMESTER POST-TEST

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Name _____ Date _____ Score ____

Block II - Manipulative Test

Installing a Washing Machine

Materials and Equipment

1. Uncrated washer; one for each student being tested
2. Tool box containing all tools needed for installation
3. Installation kit
4. Protective pad
5. Service order book
6. Appliance owner (simulated)
7. Location, including necessary plumbing facilities

Procedure 1

The student is to place appliance in proper location and proceed to complete installation.

Procedure 2

The student is to post-check appliance for normal operation and proper installation.

Procedure 3

The student is to demonstrate appliance to owner.

Quinmester Post-Test

Name _____ Date _____ Score ____

Block III - Related Test

In the space next to each component part, place a "V" for valve or a "P" for pump depending upon whether that part is found in a pump or valve.

1. Impeller ____
2. Pulley ____
3. Bushing ____
4. Sucking coil ____
5. Shaft ____
6. Diaphragm ____
7. Plunger (armature) ____
8. Flapper ____
9. Flow washer ____
10. 3/8 spout ____

Quinmester Post-Test

Name _____ Date _____ Score ____

Block IV - Related Test

Fill in the missing word or phrase to correctly complete each sentence.

1. The _____ changes rotating motion to an oscillating motion.

2. A washing machine motor having the highest starting torque would be called a _____ motor.
capacitor split-phase

3. A transmission which operated through the method of _____ would necessarily be driven by a two directional motor.

4. Oil on the floor would most likely indicate a defective _____ in the transmission.

5. A component which gradually transmits power is called a _____.

6. Most washers use _____ and _____ to transmit power from one component to another.

7. The three basic type clutches are called: a spring clutch, a _____ clutch, and a _____ clutch.

8. A split-phase motor without a centrifugal switch would have to use a _____ in order to start rotation.

9. Generally the _____ can be considered the most costly component in a washing machine.

10. A gear which only travels in an approximate 160 degree arc instead of a complete 360 degree rotation is called a _____ gear.

Quinmester Post Test

Name _____ Date _____ Score ____

Block III and IV - Manipulative Test

Component Disassembly and Reassembly

Materials and equipment

1. Work stations - each station containing a valve, pump or transmission which have been assembled to contain one defective component part each
2. Spare parts bin
3. Defective parts bin
4. Tool box containing all tools required
5. Lubricants and gaskets
6. Rags

Procedure

The student will move from station to station disassembling and reassembling the component found at each until he has completed all three (valve, pump and transmission).

At each station, the student will notify the instructor when he has disassembled the component and identified the defective part. He will then rebuild the component on instructions from the instructor, and notify him once again after the component has been completely reassembled.

Quinmester Post-Test

Name _____ Date _____ Score ____

Block V - Related Test

Associate the symptom in the right hand column by placing its letter in the space provided next to the component which may be defective.

____ 1.	Pump	a. Water won't shut off
____ 2.	Transmission	b. Knocks in agitate
____ 3.	Drive motor	c. Washer walks across floor
____ 4.	Valve	d. Soapy water on floor
____ 5.	Clutch	e. No spin, drain or agitate
		f. Slow spin

Quinmester Post Test

Name _____ Date _____ Score ____

Block V - Manipulative Test

Component Removal and Reinstallation

Materials and equipment

1. Fully complimented washers - located in an area in which they can be worked upon
2. Tool box - containing a complete set of tools
3. Protective pad
4. Rags

Procedure

The student will move from washer to washer where he will, in turn, remove a valve, a pump a transmission (and clutch), and a drive motor, one component from each appliance.

The student will notify the instructor when component has been removed, and again when he has reinstalled it, before moving on to the next appliance.

ANSWER KEY TO QUINMESTER POST-TESTS

Block I - Related Test

1.	F	6.	F
2.	T	7.	F
3.	T	8.	F
4.	T	9.	T
5.	T	10.	F

Block II - Related Test

1.	e	6.	d
2.	b	7.	b
3.	a	8.	c
4.	c	9.	e
5.	a	10.	c

Block II - Manipulative Test

Procedure 1 - Observe the following:

1. Properly locates washer
2. Selects and properly uses correct tools
3. Removes all shipping materials and brackets
4. Positions hoses properly
5. Clamps hoses properly
6. Levels appliance
7. Balances appliance
8. Connects ground wire
9. Handles safely and carefully to avoid damage to customers property
10. Cleans up

Procedure 2

1. Tests for water leaks
2. Checks operations in all cycles
3. Checks for firm levelling and balance

Procedure 3

1. Explains operators manual to owner
2. Shows owner how to handle controls
3. Observes while owner operates appliance
4. Corrects any errors and re-explains
5. Explains warranty and service policy
6. Completes service order
7. Submits service order for owner's signature

Block III - Related Test

1.	P	6.	V
2.	P	7.	V
3.	P	8.	P
4.	V	9.	V
5.	P	10.	V

Block IV - Related Test

1.	Transmission	6.	Belts and pulleys
2.	Capacitor	7.	Friction - centrifugal
3.	Reverse rotation	8.	Relay
4.	Seal	9.	Transmission
5.	Clutch	10.	Segment or sector

Block III and IV - Manipulative Test

Student is rated on the following:

1. Proper selection and use of tools
2. Orderliness (keeping things together)
3. Use of time (proper sequence)
4. Care in disassembly
5. Identifying defective part
6. Care in reassembly
7. Safety
8. Clearance adjustments (if necessary)
9. Checking rebuilt component
10. Clean-up

Block V - Related Test

1. d
2. b
3. e
4. a
5. f

Block V - Manipulative Test

Student is rated on the following:

1. Proper selection and use of tools
2. Orderliness (keeping parts together)
3. Use of time (proper sequence)
4. Care in removing parts
5. Care in replacing parts
6. Safety
7. Properly positions hoses and clamps
8. Care in handling washer
9. Post-checking appliance (simulate)
10. Clean-up